MINING AND PROCESSING SILICA SANDS AT OVERTON, NEV., BY SIMPLOT SILICA PRODUCTS, INC.

By M. Clair Smith

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MINING AND PROCESSING SILICA SANDS AT OVERTON, NEV., BY SIMPLOT SILICA PRODUCTS, INC.[1]

by

M. Clair Smith[2]

SUMMARY

This report is one of a series describing exploration, development, mining, and processing of mineral deposits in the United States. The reports are prepared and published by the Bureau of Mines in cooperation with various mining companies

The purpose of the reports is to promote development and conservation of our natural reserves by disseminating technological information on mining and milling procedures and related practices at operating mines.

Simplot Silica Products, Inc., mines and processes a friable silica sandstone. The finished products are sold for use in glass manufacture, foundries, chemicals, and special applications.

INTRODUCTION

The property of Simplot Silica Products, Inc., comprises mineral lands in sec. 3 and 11, T. 17 S., R. 67 E., and a washing plant 2 miles south of Overton, Clark County, Nev. (See fig. 1.)

Overton, a small farming community with a population of 600, is in the Muddy River Valley. The town can be reached by traveling north on U.S. Highways 91 and 93 from Las Vegas 48 miles to Glendale, then southeast 12 miles on Nevada Highway 12.

Electric power is purchased from the Rural Electrification Administration, which in turn buys it from the Hoover hydroelectric plant of the Boulder Dam project and from Southern Nevada Power Co. The power is delivered at 12,500 volts to 3,100 kv.-a. transformers near the plant, where it is stepped down to 440, 220, and 110 volts for use. Power requirements of the company average 55,000 kw.-hr. per month.

Water is supplied by two wells and the Moapa Valley Irrigation Co. One well is pumped at the rate of 250 g.p.m. This well supplies about one-half of the new water added to the circuit. The other half is supplied by the other well and the irrigation company. Some water is reclaimed from the drying platform and tailing ponds. This water is routed through four settling ponds, which supply half the water used in the mill circuit.

1/ Work on manuscript completed February 1959.
2/ Mining engineer, Bureau of Mines, Region II, Reno, Nev.

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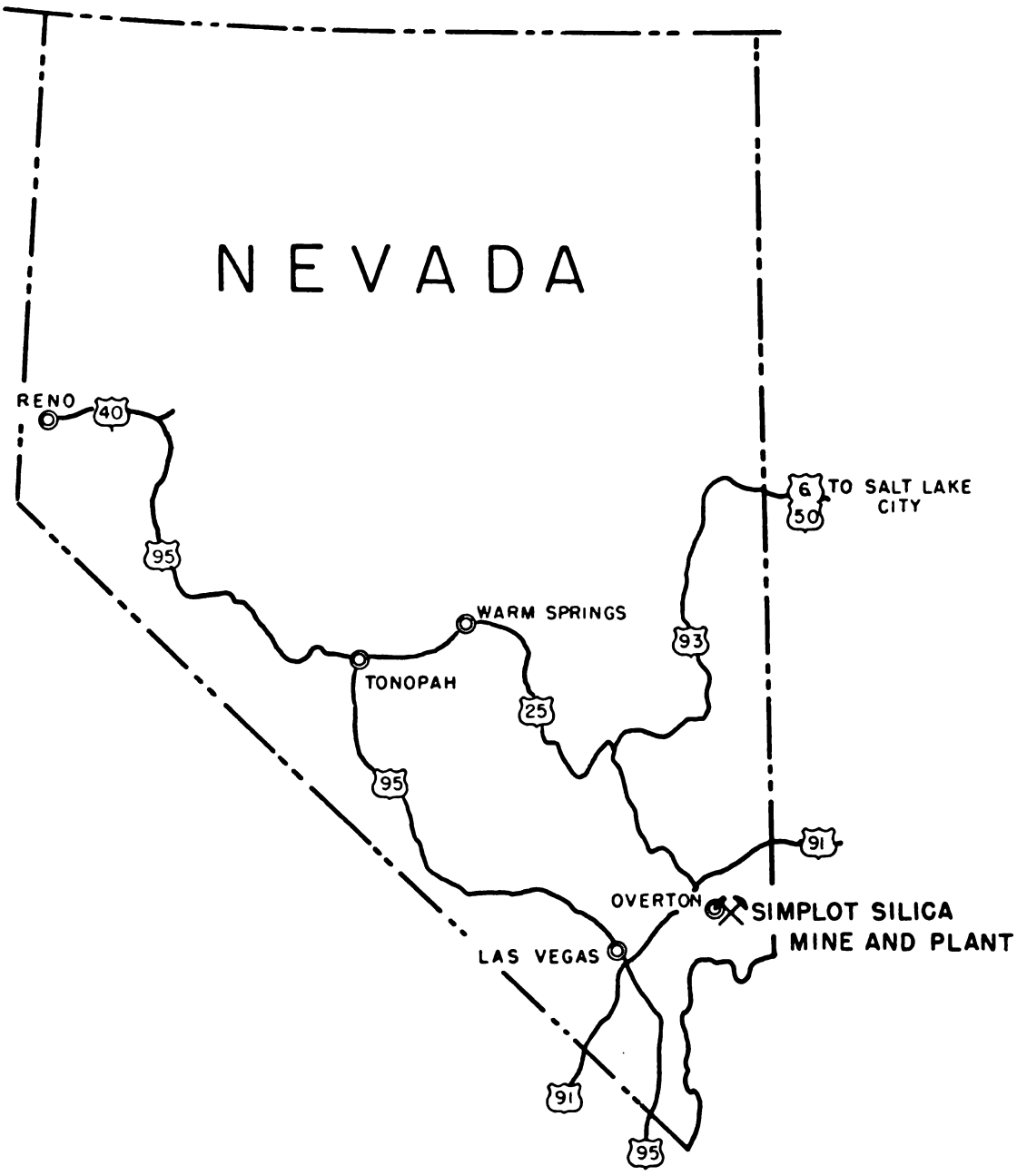

FIGURE 1. - Location Map, Simplot Silica Products, Inc., Mine and Plant.

ACKNOWLEDGMENTS

Acknowledgment is made to the Simplot Silica Products, Inc., for permission to publish this report. Special acknowledgment is due J. R. Simplot, president; George A. McHugh, manager of mines; Keith Madill, manager of the Silica Products Division; and Donald Ferguson, superintendent. The author

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acknowledges the assistance of S. A. Robinson, geologist for J. R. Simplot Co., in writing the geology of this area.

HISTORY

The Simplot property was owned in 1937 by W. R. Cozart,[3] who shipped 112 carloads of sand. The property was then under lease to Paul and Fred Nunn. The Nunn Co. constructed a washing plant 2 miles south of Overton, and produced sand continuously to 1955. The Nunn Co. sold its lease and property to Simplot Silica Products, Inc., in February 1955. Approximately 1,400,000 tons was mined at the old pit in sec. 11. A new pit was begun in sec. 3, 3,000 feet northwest of the old pit, in March 1958.

GEOLOGY

Sands of glass-making quality occur in the lower member of the Baseline sandstone, a crossbedded sandstone probably of Jurassic age. The thickness of the glass-sand bed ranges from 400 to 700 feet on the Simplot property; the bed strikes N. 40° W. and dips 25° to 40° NE. The formation consists of poorly cemented, white or gray sandstone, which grades upward into red sandstone and beds of conglomerate; the whole formation measures more than 3,000 feet in and near the Baseline Wash. The formation is largely reworked sand from the Red Aztec sandstone of Jurassic age.[4]

Overlying the Baseline sandstone, with a strong angular conformity, are virtually flat-lying beds of the Muddy Creek formation, probably of Miocene age. These have been removed by erosion over about half of the Simplot property and reach a maximum thickness of 90 feet just west of the old pit.

Sands of glassmaking quality occur in the lower member of the Baseline sandstone and are exposed from the United States Silica Co. (Nevada Silica Sands Co.) pit near the center of sec. 12, T. 17S., R. 67 E., on the southeast, across the old pit of the Simplot company in sec. 11 and across Kaolin Wash into sec. 3, covering an overall distance of nearly 2 miles.

The zone of glass-quality sand trends approximately N. 75° W. and crosses the bedding planes at an angle of about 35°; the glass sand appears stratographically higher from northwest to southeast.

It is believed that the glass sands represent an old beach deposit, where washing by wave action removed most of the iron oxide coating from the sand grains. A regressing sea caused the washed and sorted sands of the lower member of the Baseline formation to be covered by coarser material. This material contains red stains and numerous conglomerate lenses. Down dip the lower member of the Baseline formation grades into gray to buff clays of the Willow Tank formation of Upper Cretaceous age.[5]

3/ Vanderburg, W. O., Reconnaissance of Mining Districts in Clark County, Nev.: Bureau of Mines Inf. Circ. 6964, 1937, p. 65

4/ Longwell, Chester R., Structure of the Northern Muddy Mountain Area, Nev.: Bull. Geol. Soc. America, vol. 60, May 1949, pp. 923-968.

5/ Work cited in footnote 4.

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The glass sand is a friable sandstone, buff to white, with well-rounded grains largely free of fractures. Approximately 65 to 70 percent of the grains are minus-50- to plus-140-mesh. At the present pit the sandstone bed is 500 feet wide, strikes northwest, and dips 43° NE. Reserves are estimated to be sufficient for 50 years at the present rate of production.

EXPLORATION

Seven rotary-drill holes ranging in depth from 188 to 355 feet were drilled on the Simplot property in the new pit area. Drill-cutting samples were collected at 15-foot intervals. These samples were classified according to color, grain size, screen analysis, and iron content. The samples of each classification were combined and assayed.

Channel samples were cut from northeast to southwest across the glass-sand zone where it was exposed in the main fork of Kaolin Wash. The samples were screen-sized and assayed for iron.

The drill holes were located about 800 feet apart along the strike and 300 feet apart across the strike of the sandstone.

Drill cuttings from the holes showed that about 8 percent more of this material passed through a 100-mesh screen than material from the channel samples and from a grab sample taken at the old pit. The increase in minus-100-mesh material is attributed to the comminution of the sand grains within the drill holes. Products taken from the processing plant for the past 3 months indicate that this assumption is correct.

As the quality of the sand in the new area appeared to be as favorable as in the old pit and as little overburden had to be moved, it was decided to move the mining operation. A new road was built from the washing plant up Kaolin Wash to the site of the new pit, and mining was begun at this site March 1, 1958.

MINING

The glass-sand formation is cut for a depth of about 90 feet by the wash. The wash is narrow where it cuts the formation. The bottom of the wash was leveled, and mining was begun on the north side. The sandstone face is exposed 500 feet along the wash and 90 feet in height. (See fig. 2.) There is no overburden on the sandstone; a few residual nodules of iron are removed by hand before the sandstone is blasted.

Drilling is done with a model BHDC Porta-drill mounted on an International, Model R-190, 2-ton truck. The drill and compressor are run by power from the truck. The compressor has a capacity of 600 c.f.m. at a pressure of 90 pounds. Holes 3-7/8 inches in diameter, spaced 18 feet apart, are drilled from the top of the deposit to the floor of the pit. The first row of holes is about 25 feet back from the face; the next rows are 18 feet apart.

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FIGURE 2. - Sandstone Quarry of Simplot Silica Products, Inc., Showing Mining Equipment.

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Blasting is done with 65-percent dynamite, detonated with Primacord and an electric cap. The holes are filled with explosives to within 15 feet from the top. Usually 30 to 50 holes are blasted at one time to break enough material for 3 to 4 months of normal production.

The rotary drill is used on a rental basis. When it is not available and drilling is necessary, an Ingersoll, Model DA 30, wagon drill is used. Air is supplied to this drill by a 600-c.f.m. portable compressor. The wagon drill holes are 2-1/4 inches in diameter and 12 feet apart in both directions; they are drilled to a depth of 24 feet. The sandstone is well fragmented by the initial blast, and little secondary blasting is required. Usually 500 feet of 3-7/8-inch holes is drilled per shift with the rotary drill. The powder consumption is about 1 pound for 3 tons of broken rock. The cost of drilling and blasting is approximately 7 cents per ton.

Broken rock is loaded into 20-ton capacity Euclid trucks with a Koehring, 3/4-yard electric shovel (fig. 2). Power is delivered at 440 volts to the shovel, which is rated at 50 hp. Two trucks haul the rock from the pit to the scalping plant, a distance of 1 mile; 550 tons of sandstone is loaded and hauled in an 8-hour shift.

SCALPING PLANT

Material hauled from the pit is dumped onto a rail grizzly with 10-inch spaces over a 12- by 12-foot sloping-bottom bin. From the bin the sandstone is fed by a short conveyor belt to a locally designed revolving grizzly, consisting of 12 parabolic steel disks spaced 2 inches apart. The disks are eccentrically mounted on a revolving shaft. As the grizzly revolves, the minus-2-inch material falls between the disks, and the plus-2-inch material is carried over and falls into a 12- by 18-inch jaw crusher set to crush to minus-2-inch.

The minus-2-inch material is conveyed 93 feet by a 16-inch belt conveyor to a 4- by 8-foot, Overstrom, single-deck vibrating screen. The oversize from the screen goes to a 25-ton waste bin and is hauled away by the trucks on the return to the mine. The minus-3/8-inch material is conveyed from the screen to one of three bins by a 40-foot cross conveyor belt. One bin has a live capacity of 200 tons; each of the other two has a capacity of 50 tons. (See fig. 3.) The better sand disintegrates with blasting, loading, and crushing so that it passes through the 3/8-inch screen.

Clayey material does not pass through the 3/8-inch screen. The clays and coarser sand, which approximate 8 to 15 percent of the mined material, go to the waste bin. The clayey material contains a large part of the extremely fine sand; therefore, by discarding the plus-3/8-inch material, much of the fine sand is lost before the washing-plant circuit is reached.

WASHING PLANT

Material from the scalping plant is hauled to the washing plant by 2 propane-powered White semitrucks, each having a capacity of 22 tons. The distance between the two plants is 3-1/4 miles.

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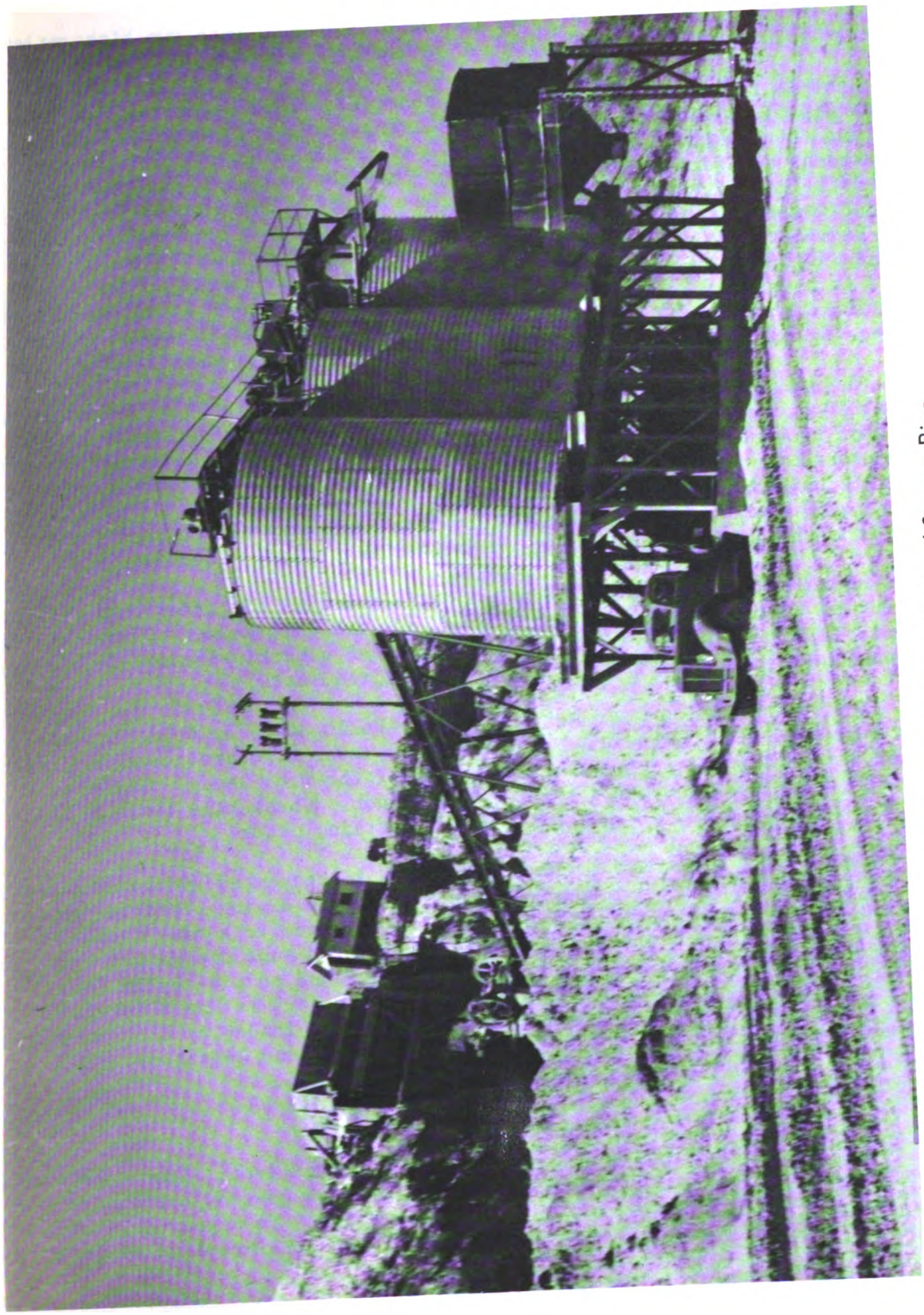

FIGURE 3. - Scalping Plant and Storage Bins.

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At the washing plant (fig. 4) the sand is dumped into two bins; one has a capacity of 150 tons and the other of 50 tons.

Sand is fed from the bins by belt conveyor, or flows hydraulically through 8-inch pipelines to a 5- by 25-foot revolving scrubber. Water is added at the feed end of the scrubber with the sand. At the discharge end of the scrubber, two screens separate the minus-3/16-inch from the plus-3/16-inch material. The plus-3/16-inch material goes to the waste circuit. The minus-3/16-inch material and water pass through the screens and are conveyed by troughs to two 6-foot-diameter by 4-foot trommels with 24-mesh screens; half of the sand goes to the inside of each trommel. Plus-24-mesh material clings to the screen until it revolves to the top, where it drops onto a trough 24 inches wide and is sluiced to the waste circuit. Minus-24-mesh material is washed through the screens on the trommels and goes to a 3- by 10-foot hydroclassifier.

The underflow from this hydroclassifier goes to two 2- by 8-foot hydroclassifiers, from which the underflow goes to a 3- by 16-foot screw classifier. The sand product of the screw classifier discharges onto a conveyor belt and is conveyed to the drying platform. The overflow from the three hydroclassifiers is pumped to a 2- by 8-foot secondary hydroclassifier; the underflow is a fine sand product. The overflow from this secondary hydroclassifier and that from the screw classifier go to the tailings pond. (See fig. 5.)

Washed sand stored on the drying platform drains and dries to a moisture content of approximately 3 percent. If sand with this amount of moisture is acceptable to the consumer, it is loaded with an electric-powered double-drum scraper and conveyor belts into trucks or railroad cars.

The 100- by 300-foot drying platform is built of 2- by 6-inch redwood placed on edge with narrow spaces between. A layer of coarse rock is placed on top of the redwood floor and sand on top of the rock layer. Perforated drainage tile are laid beneath the redwood floor. These tile lines collect the drainage water and discharge it to the settling ponds.

If sand with less than 3 percent moisture is requested by the consumer, the sand is loaded with an electric scraper from the drying platform onto a 170-foot belt conveyor. The conveyor carries the sand to a bin, where it is fed to a 6- by 30-foot, oil-fired rotary drier. The sand discharges from the drier into a screw conveyor that conveys the hot sand to a 4- by 16-foot rotary cooler. After the sand goes through the cooler, it has a moisture content of less than 1 percent and is cool enough to be loaded by belt conveyor into railroad cars or trucks. The washed and dried sand weighs 90 to 92 pounds per cubic foot.

FOUNDRY SAND

Washed white sand contains less than 0.05 percent iron. Some consumers of molding sand do not require a sand with a low iron content but specify that it shall contain a larger proportion of coarse sizes. To supply this demand, Simplot Silica Products, Inc., is mining a red, iron-stained sand deposit in

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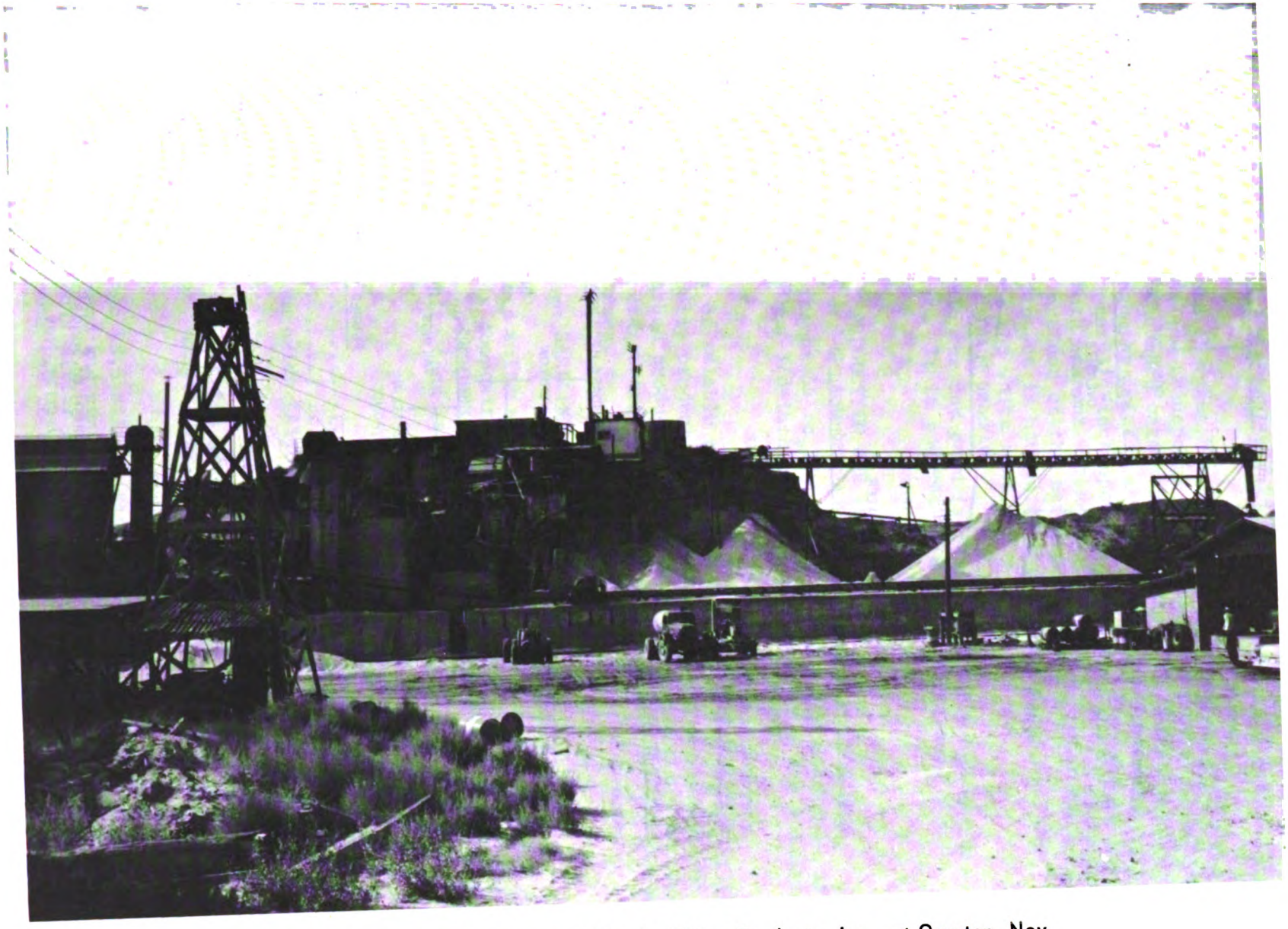

FIGURE 4. - Washing Plant of Simplot Silica Products, Inc., at Overton, Nev.

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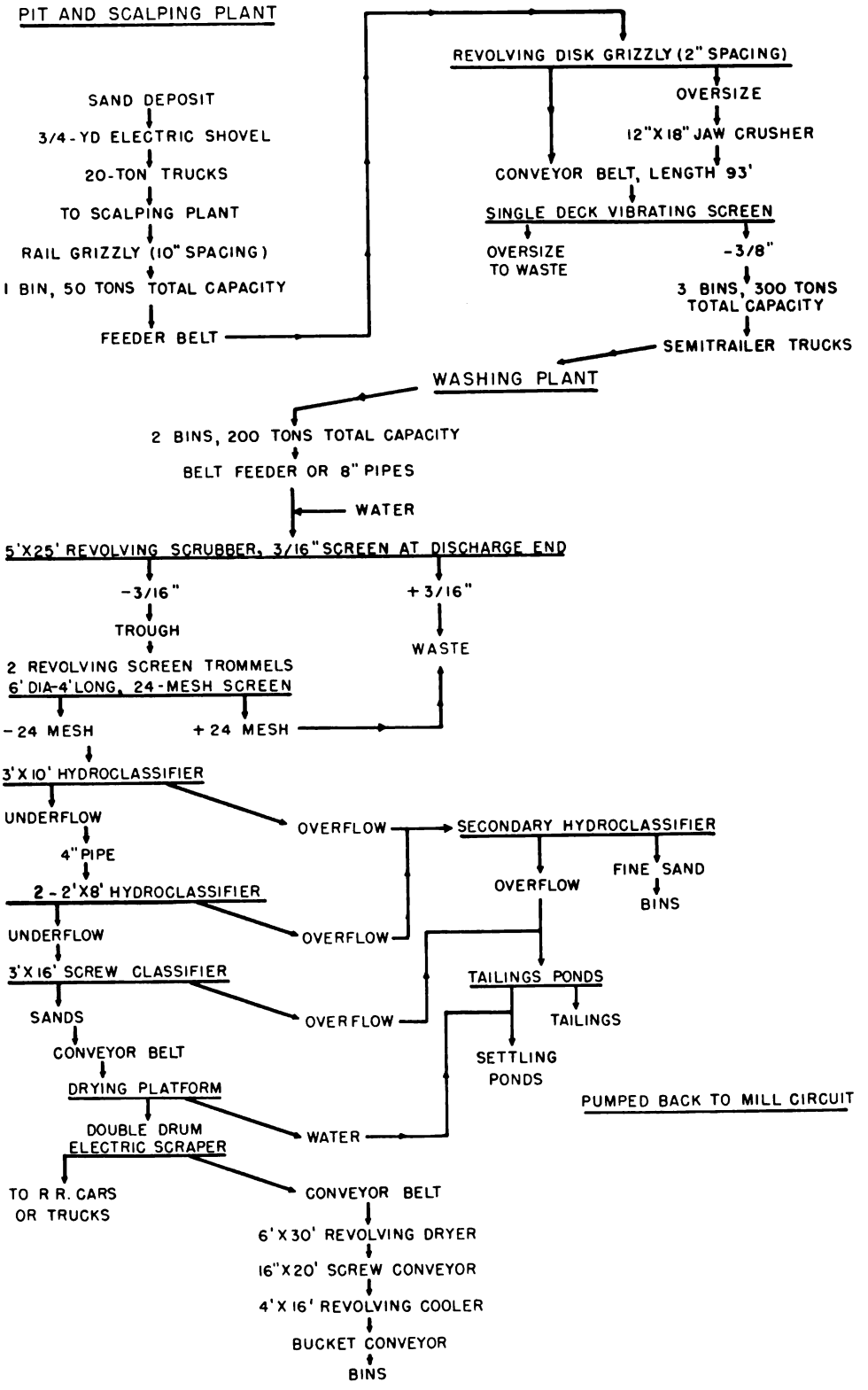

FIGURE 5. - Flowsheet Showing Treatment of Sandstone by Simplot Silica Products, Inc., at Overton, Nev.

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Kaolin Wash, 1-1/4 miles from the washing plant. This deposit contains considerable gravel and is about 20 feet thick where it is being mined.

The deposit is stripped of vegetable growth and overburden with a bulldozer. A scoopmobile loads and transports the sand to a portable screening plant. Sand and gravel are dumped onto a bar grizzly with 2-inch openings. The material passing through the grizzly is conveyed to a double-deck vibrating screen; the top screen has 3/4-inch openings and the lower screen 1/4-inch openings. Oversize from both screens discharges into a truck and is hauled away with the plus-2-inch product of the bar grizzly for road-surfacing material. The minus-1/4-inch product is hauled to the washing plant and goes through the same process as the white sand.

Equipment used to scalp the red sand is readily portable and may be moved from one deposit to another. It is powered by a 20-hp. generator that delivers 440 volts.

PRODUCTION AND PRODUCTS

Salable products represent 55 to 70 percent of the mined material, or 70 to 85 percent of the minus-3/8-inch material recovered from the scalping plant.

In 1957, 85,000 tons of salable products was produced by Simplot Silica Products, Inc. Average daily production of 550 tons at the pit yields 300 to 350 tons per day of washed products. Ordinarily, 40 percent of the production goes to glass manufacturers, 40 percent to foundries, and 20 percent for chemical and special uses.

SAMPLING AND ANALYSIS

A sample of the washed white sand is taken each day and a composite made of 15 daily samples. This composite sample is split; half is sent to Lancaster, Ohio, for analysis, and half is retained by the company. A representative analysis of the washed white sand is:

	Percent
Silica (SiO_2)	99.4
Iron oxide (Fe_2O_3)	.045
Aluminum and titanium oxide (Al_2O_3 and TiO_2)	.555
Total	100.000

Average screen analysis of the glass sand is: 100 percent through 20-mesh; not over 20 percent, minus-100-mesh; and not over 5 percent, minus-140-mesh.

Foundry sand averages 98.6 silica (SiO_2) and is higher in iron oxide (Fe_2O_3) than the glass sand and considerably coarser. The fine sand recovered from the secondary hydroclassifier averages 90 percent minus-100-mesh material. The market does not consume the total output.

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A typical screen analysis of the sand, as mined, follows:

	Percent
Plus-30-mesh	0.6
Minus-30-, plus 40-mesh	4.4
Minus-40-, plus 50 mesh	10.9
Minus-50-, plus 70-mesh	17.7
Minus-70-, plus 100-mesh	25.5
Minus-100-, plus 140-mesh	21.8
Minus-140-, plus 200-mesh	13.0
Minus-200-, plus 270-mesh	4.3
Minus-270-mesh	1.8
	100.0

COSTS

The cost of producing the washed sand is distributed as follows:

	Percent of total cost
Mining (includes trucking to scalping plant)	13
Scalping (includes trucking, scalping plant to washing plant)	5
Washing	41
Sales, management, and office	13
General (insurance, road maintenance, vacation pay, payroll taxes, royalties, property tax)	28
	100

Twenty-one employees work 5 to 7 days a week at the Simplot Silica Products, Inc., mine and plant. The average wage is $2.20 per hour.

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